

REAL-TIME EXPERT SYSTEM FOR ADVISING ANESTHESIOLOGISTS IN THE CARDIAC OPERATING ROOM

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Abstract This paper describes the initial work towards building a distributed real-time expert system for advising anesthesiologists in the cardiac operating room. The goal of this project is to build a vigilant system that contains knowledge relevant to the practice of cardiac anesthesiology. The system is being designed to use this knowledge in conjunction with continuous automated patient data acquisition in order to provide clinically useful differential diagnoses and treatment recommendations in real time.

1 INTRODUCTION

This report describes a prototype system that has been developed at The Mount Sinai Medical Center. This system attempts to go one important step further than existing systems [1,2,3] towards generating treatment recommendations in real time based upon on-line measurements, pharmacokinetic models and the patient's medical history. The goal of this project is to build a system that contains a reasonable amount of knowledge relevant for the practice of anesthesiology and to utilize this knowledge in conjunction with measurements of patient's state, knowledge of patient's medical history and pharmacokinetic models, providing responsive and useful information in real time. The system will be evaluated on case files generated from the CompuRecord (ARI, Pittsburgh, PA), of which approximately 20,000 are already available. The features of the system are:

- **Accuracy.**
- **Explanation.** The system needs to clearly present its "train of thought" and be able to respond to "what-if" questions
- **Responsiveness.** The system is designed to provide timely recommendations for treatment.
- **Truth maintenance.** The system maintains a network of interdependencies between differential diagnoses and computes their belief measures.

2 SOFTWARE ARCHITECTURE

The main software modules that comprise the expert system are (see Figure 1):

1. The **Rule Base and the Dictionary**. This module contains the algorithmic knowledge in the form of OPS-5 rules and lists of relevant information on diseases, drugs and procedures in form of hash tables.
2. **Knowledge Processing Module**, embedded within the LISP environment with OPS-5 interpreter
3. The **Pharmacokinetic Module** that contains simulation models of drug concentrations
4. **Data Acquisition and Signal Conditioning** modules that prepare measurement data and data trends for processing in the **Knowledge Processing Module**

5. **Concentrator Module** that serves as a "blackboard" for funneling data to other modules
6. (Optional) **Report Generation** module that prepares the output in the form of correct English sentences.
7. The **Hypertext GUI** that presents the system's advises in the form of hierarchical hypertext structure (see Figure 2)

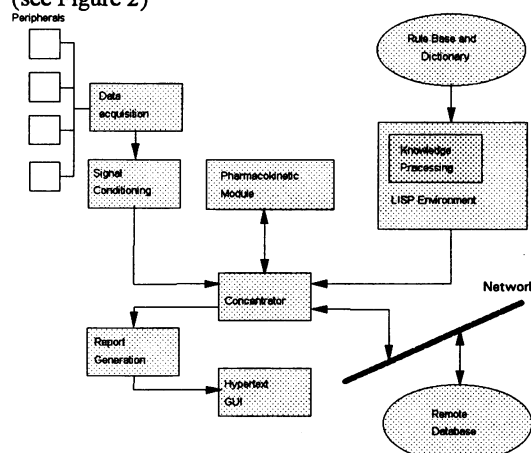


Figure 1. Main software modules of the expert system

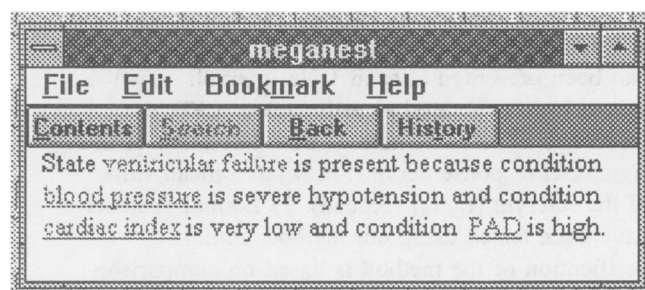


Figure 3. System's output in the hypertext form. Underlined clues are pointers to additional information.

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